Directorate for Geosciences (GEO)
Office of the Assistant Director (OAD)

Response to the 2006 Committee of Visitors Report: Geosciences Education and Diversity (GEO E&D) Programs
FY 2009 Update

1 RESPONSE TO RECOMMENDATIONS FOR ALL PROGRAMS

The Directorate notes that many of the specific comments provided in the COV report for individual programs have common themes that apply across the portfolio. Among these themes are the need for the Directorate to define a strategic context for GEO's E&D investments; to improve outreach to Minority-Serving Institutions in order to broaden participation of underrepresented PIs; and to establish greater consistency in the protocols used in conducting the review process, including better guidance for reviewers and panelists regarding the application of the Broader Impacts criterion and enhanced feedback for PIs. In this section, we provide an overview of these general comments for the entire portfolio and the Directorate's response to them. In subsequent sections related to individual programs, we reference these program-wide comments and our proposed responses, where appropriate.

1.1 INTEGRITY AND EFFICIENCY OF PROCESSES

1.1.1 Using Appropriate Review Strategies

The COV found the GEO E&D programs' processes to be exemplary, particularly in terms of the professionalism of the staff and the integrity of conduct, and found the balance of the portfolio between traditional, high-risk and innovative projects to be appropriate. The COV commented that the use of different review strategies (ad-hoc versus panel or mixed reviews) seemed to be appropriate for specific programs. The COV expressed some concerns regarding the expertise of reviewers and panelists, noting the importance of finding suitable educational and disciplinary knowledge when reviewing the highly diverse suite of proposals submitted to these programs. The committee was unable to judge whether this goal had been met, because of a lack of background information about the reviewers presented in the COV materials. (2.1 & 3.4)

GEO Response: We are very pleased with the COV's favorable comments regarding the review process and will continue to apply the most appropriate review mechanism for each program. The program wholly agrees with the COV that reviewers with diverse and fitting expertise are needed, particularly for the GeoEd program, which receives proposals with a broad range of project ideas. The program is committed to expanding

the pool of available reviewers for the GEO E&D programs through outreach to the community, discussions with program officers in other Directorates, and active recruitment through the NSF web site. An NSF-wide initiative to link the reviewer and PI databases and add capabilities for searching these databases using a variety of criteria, including disciplinary expertise, institutional demographics, and individual demographics, is currently in the design phase at NSF. Implementation of these new features should help with both identifying appropriate reviewers and documenting their attributes for future COVs.

It is the program's view that a combination of ad-hoc and panel reviews is ideal because it provides feedback from experts who are closely familiar with a particular sub-discipline (ad-hoc review) as well as comparative evaluations regarding a project's potential significance across a diverse range of proposed activities (panel review). Unfortunately, it is not always feasible to obtain both types of review for all programs. This is partly due to the relatively small size of the geoscience education community which serves as the potential reviewer pool, but also due to conflict of interest issues that arise for specific competitions. In particular, the GEO-Teach and GLOBE programs, which involved very large collaborations (and thus multiple conflicts), were not amenable to an ad-hoc review process. The COV reviewed GeoEd proposals from the 2005 competition, which utilized a panel review only. Beginning with the 2006 GeoEd competition, the program has started to use, and will continue to use, a combined ad-hoc and panel review, with the goal being to obtain a minimum of 4 written reviews per proposal. For the 2006 competition, several of these written reviews were submitted by panelists, but the program is working to expand the pool of reviewers in order to have all written reviews be submitted by ad-hoc reviewers who did not serve on the panel. For now, the OEDG program will continue to use a panel only review process, but it is possible that a combined ad-hoc/panel process will be instituted if additional qualified reviewers can be identified.

FY 2009 Update: The GEO E&D programs continue to identify new, qualified reviewers through outreach efforts at the AGU, GSA, and SACNAS annual meetings the Joint Annual Meeting of Principal Investigators (JAM PI) supported through the Human Resources Development Division of EHR, as well as through interactions with other program officers in NSF and the geoscience education and research communities. The GEO E&D program continues to expand the reviewer pool and now has over 600 scientists and educators to draw from for ad hoc and panel reviewers.

The GEO E&D programs managed in the GEO Office of the Assistant Director have held two competitions using external merit review since the 2007 COV report was received: FY 2008 GeoEd and FY 2009 OEDG. For the 2008 GeoEd competition, the program used a combined ad-hoc and panel review. Unlike the previous GeoEd competition, the program contacted over 500 reviewers in advance of the 2008 GeoEd proposal deadline to determine their willingness to participate in the proposal review process. Approximately 250 of these reviewers were new to our reviewer pool, and about 50% of those contacted provided a response. This process produced a much higher ad-hoc response rate. A similar process of contacting reviewers prior to the

proposal deadline was used for the 2009 OEDG competition, with similar success in identifying a pool of willing reviewers. For the 2009 OEDG competition, there was panel-only review for Track 1 proposals and a combined ad-hoc and panel review for the larger and more costly Track 2 proposals. Until the reviewer pool for the OEDG program can be further expanded, we feel that it would place too large of a burden on the reviewers to include the Track 1 proposals in the ad-hoc review process.

1.1.2 Application of the Broader Impacts Criterion

Among the concerns expressed by the COV was the inconsistency in effective response provided from reviewers, particularly panelists (as reflected in the Panel Summary), as to the application of the Merit Review Criterion 2, Broader Impacts. This could be helped by examples of effective activities that accomplished Broader Impacts, more specific instructions to the reviewers and panelists, a more active role by program officers in emphasizing the requirement, and modification of the template for panel reviews to include two boxes – one for each criterion. (2.1 & 3.3)

GEO Response: The Directorate agrees that greater and more consistent guidance needs to be given to reviewers and panelists regarding the Broader Impacts Criterion, and agrees that using a template for panel reviews that explicitly calls out the two criteria is an appropriate strategy. It is worth noting that the Review Analyses written by program staff when making funding recommendations now separately address the intellectual merit and broader impacts criteria. In the next six months, the GEO Education Team (GET), which is comprised of NSF program officers from GEO and the Education and Human Resources (EHR) Directorate, will be working to establish a set of consistent protocols for how to instruct reviewers and panelists about the review process for use by all of the GEO E&D programs. The GET will consider the comments suggested by the COV in Sections 3.3 and A.1.6 as part of that process. Letters providing instructions for reviewers and panelists, slides used in pre-panel orientations, and Panel Summary templates will be revised accordingly. These efforts are being undertaken within the broader context of NSF-wide efforts to improve the Merit Review process; as part of these efforts, the supporting documentation that elucidates what NSF means by the two review criteria are being revised and instructions related to the Broader Impacts Criterion specifically are being strengthened.

FY 2009 Update: The GEO E&D program has provided explicit guidance to reviewers and panelists regarding the need to separately consider and comment on the broader impacts criterion in making assessments regarding the merits of a proposal under review. A panel summary template that has separate Intellectual Merit and Broader Impacts sections has been provided to panelists for the 2008 GeoEd and 2009 OEDG competitions. GEO is working to develop a pilot set of panel briefing materials that highlight some examples of effective broader impacts related to education and broadening participation, culled from more traditional research projects. The challenge in defining exemplary broader impacts for the education and diversity projects is that they are intrinsically focused on what are traditionally viewed as broader impact-type activities (e.g., working with teachers and K-12 students; supporting broadening participation) and so the intellectual merit criterion incorporates some of these elements.

The program will continue to compile examples of how this criterion can be addressed most meaningfully through the GEO E&D projects.

1.1.3 Feedback to Investigators

Another concern is the inconsistent response to declined proposals with regard to encouraging resubmission. Not all declined proposals should be recommended for resubmission, but a certain number of proposals may have been declined simply due to lack of available funding, or a deficit in an area that could be readily addressed. The current decline letter template does not encourage program officers to provide detailed feedback or advice regarding opportunities for improvement, and/or encouraging PIs to call their program officer to discuss the potential of revising the proposal for resubmission. (2.1 & 3.2)

GEO Response: There are three mechanisms for providing feedback to PIs regarding future resubmission of their proposal. The declination letter template available through the e-Correspondence module is written very generally and thus does not lend itself to this type of individualized feedback for specific proposals. The program officer also has the ability to generate Program Officer (PO) Comments for individual proposals, which are made available to the PI in FastLane along with the ad-hoc reviews, Panel Summary, and Context Statement after the funding recommendation has been concurred by the Division Director. It appears that the COV was unaware that these PO Comments are accessible to the PI. The use of this capability during the period under review by the COV was inconsistent, depending on program officer, however. Beginning in 2006, the GeoEd, GLOBE, GEO-Teach, OEDG, and EAR/HR programs have all utilized the PO Comment tool to provide explicit feedback to PIs regarding their proposals and whether they should be revised and resubmitted or they are not appropriate for the program. It is also very typical for program officers to discuss with the PI by email or phone the proposal's outcome and potential for resubmission, once the PI has had an opportunity to digest the comments in the reviews and Panel Summary.

FY 2009 Update: The GEO E&D program continues to use the PO Comment tool to provide PI feedback and 100% of PI's who submitted proposals to the 2008 GeoEd and 2009 OEDG competitions that underwent merit review received PO comment feedback. This feedback explicitly identified whether the proposal had merit and should be resubmitted in the future; had merit but should be submitted elsewhere in NSF; or had some fundamental weaknesses that would require substantial revision before resubmission.

Finally, there is the problem of overly terse and/or negative reviews. Reviewers should be instructed to consider the review process as an opportunity for mentoring colleagues and building a stronger national community of geoscience educators and researchers. (2.1)

GEO Response: As noted above, the program is working to establish and implement more consistent procedures for all of the GEO E&D programs with regard to instructing

reviewers and panelists on the process and GEO's expectations regarding content. Reminding reviewers of the opportunity to mentor colleagues will be a component of that guidance.

FY 2009 Update: Reviewers were explicitly instructed at the 2008 GeoEd and 2009 OEDG panels to refrain from writing overly negative reviews, and to use the review process as an opportunity to mentor colleagues. The program finds the tone of reviews to have been largely very constructive in these competitions.

1.2 OUTPUTS AND OUTCOMES

1.2.1 Defining a Strategic Context for GEO*'s* E&D Investments

The COV did not see evidence that the 2003-2006 GEO E&D programs were highly influenced by the previous NSF strategic plan and its outcome goals. The COV was provided a few examples of nuggets of projects that represented successful outcome goals for several specific areas of the three broad People, Ideas, and Tools outcome categories. Time limitations did not allow the COV to investigate this subject in any detail. (2.2)

GEO Response: With the exception of the OEDG program, which was initiated in response to a GEO strategic plan focused on diversity, the other GEO E&D programs have evolved over time in response to several strategic planning activities within the Directorate. These programs have been shaped by inputs received via meetings of the AC-GEO and its Education & Diversity Subcommittee, GEO Management retreats, two meetings of the Geoscience Education Working Group (GEWG), and the 2003 COV report. In the past three years, specific program solicitations have been revised in response to these inputs, which has helped to give them more specific focus. However, GEO agrees that an over-arching strategic vision for the comprehensive GEO E&D portfolio has been lacking and is needed. This strategic vision would both articulate how the GEO E&D portfolio serves Foundation-wide strategic goals and objectives and more clearly delineate the relationship between individual program elements within the portfolio. A major goal for the GEO E&D program in the next 12 months is to work with the geoscience education community to shape this strategic vision for the GEO E&D programs and make it available through the GEO web site so that it can inform future program solicitations and proposal submissions. This effort will be carried out through a combination of community workshops (e.g., to define priority research areas related to geoscience education research), a day-long retreat of the GEO Education Team, and consultation with other non-education focused program officers within GEO. This effort will be closely tied to activities of the GEO Vision Working Group, which is in the process of defining broad Directorate-wide priorities for the coming 5-10 years, including those related to geoscience education. Fortunately, all of the major GEO E&D program solicitations will require re-release after November 2007, which will allow revisions to be made that are consistent with this new strategic plan.

FY 2009 Update: A draft GEO Education and Diversity Strategic Framework outlining goals, objectives, approaches, and programmatic priorities was presented to the

Advisory Committee for GEO on October 14, 2009. The framework was written to reflect priorities outlined both in the current NSF Strategic Plan and the recently released GEO Vision document. AC-GEO endorsed the framework, with minor modifications, and a final draft is in preparation. This strategic framework is being used as the foundation for revision of the GeoEd solicitation currently underway. Common language that reflects the overarching priorities of the GEO E&D portfolio as outlined in this strategic framework will be included in the introduction section of all future solicitations associated with the GeoEd, OEDG, GLOBE, and GEO-Teach programs, for the period during which that strategic plan is active. In addition, the GEO web site will be updated to include this strategic plan as a resource for the PI community. Outreach at forthcoming meetings (e.g., AGU, GSA), and perhaps a Dear Colleague Letter, will be used to help educate the community about this plan.

An NSF Climate Change Education (CCE) Working Group was established on October 1, 2009. The charge of this group is to articulate a cross-directorate strategic vision regarding NSF's climate change education investments and develop a dedicated CCE solicitation. With the GEO Program Director for Education and Diversity as Co-chair of this working group, it is expected that the CCE strategy will be highly complementary to the GEO E&D Strategic Framework. Similarly, continuing interagency conversations through the US Global Change Research Program's Education Interagency Working Group will facilitate making NSF's strategic plans cohesive with, and complementary to, related investments being made by other agencies.

In preparation for the 2010 COV, the program is in the process of compiling more information that can be used by the COV to evaluate whether recent GEO E&D investments are aligned with the goals and outcomes of this strategic plan.

The COV recommends that the new GEO E&D leadership team consider initiating a dialogue with a wide range of current and potential stakeholders in the geosciences education community, in order to shape a planning process, share NSF strategic goals relevant to the GEO E&D program, and explore opportunities for future initiatives. Special emphasis should be placed on a stakeholder driven plan for enhancing participation by a broader group of MSI's. (3.1)

GEO Response: The program agrees that community engagement is essential in crafting a strategic plan for future GEO E&D investments. Since the COV met, program staff have attended meetings of the Coalition for Earth System Education and convened a meeting at NSF of all education program managers associated with the major facilities and Science and Technology Centers (STCs) which focus on geo-related research. Ongoing conversations with program managers at sister agencies, including NASA, NOAA, USGS, and DOE, are exploring mechanisms to encourage the community to establish uniform guidance on what is meant by Earth System Science Literacy. As part of this effort, NSF is supporting a workshop to establish Atmospheric Science Literacy concepts in Fall 2007 and planning is underway for an EAR/EH-supported workshop related to the Earth Sciences for later in the year. A community workshop to define emerging opportunities and priorities related to geoscience education research is being

planned for FY 2008. Discussions are underway for intra-NSF and inter-agency coordination related to climate change education, pending new Congressional funding. The program expects to hold community Town Hall discussion at the 2007 Fall AGU and GSA meetings and Winter 2008 AMS meeting to share the preliminary outcomes of these various initiatives and invite community feedback and engagement.

FY 2009 Update: In the past year, the Atmospheric Science Literacy, Earth Science Literacy, and revised Climate Literacy frameworks have been published and disseminated. A special session at the 2009 Fall GSA meeting highlighted how these documents are serving as important framing guidelines for development of new resources (e.g., textbooks and museum exhibits) associated with Earth system science education. Discussions are underway at the National Academies regarding the development of common core science standards that may be organized through cross-disciplinary themes such as Earth system science. One argument being made is that Earth system science can both increase engagement of students, including those from underrepresented communities, in STEM fields and promote learning of STEM concepts. The College Board released *Science College Board Standards for College Success* in September 2009, which identifies the science standards and preparatory knowledge needed to be ready for college and the Advanced Placement program; this report specifically describes a separate Earth Science track, even though there is no AP Earth Science exam. In conjunction with the FY 2009 Climate Change Education funding that came to NSF, which required consultation with the National Academies, an award was recently made to the Academy to establish a round-table regarding Climate Change Education. One goal of this round-table is to explore the reforms in Earth system science education that may be required nationwide if we are to increase exposure to climate science content, particularly in the K-12 classroom. Integration of the individual literacy documents into a cohesive Earth System Science Literacy document is likely to be done through this round-table; if not, it will be pursued through separate action. Recommendations that arise through these combined discussions within the STEM and geoscience education communities could have profound implications for the GEO E&D program priorities going forward.

GEO would benefit from having a single document that describes the rationale and distribution for the total investment in education activities and places the GEO E&D investments within the broader context of GEO-wide investments in education. Defining how the current balance of investments in education is appropriate to achieving the goals of the NSF strategic plan and considering whether it would be more effective to allocate and distribute some of the education funds across the Directorate to achieve greater diversity are both recommended. (4.0)

GEO Response: The program agrees that the COV has raised valid concerns and, as noted above, a rationale for GEO's investments is currently under development. Given current tracking capabilities, it is challenging to separate out the specific investments being made throughout the Directorate related to education and diversity that are being supported through normal research grants. Defining this investment for the major facilities and STCs is probably a more tractable problem. As part of the newly passed

America Competes Act, new requirements are being imposed on NSF with regard to evaluating, and reporting to Congress on, the investments and outcomes associated with the Broader Impacts criterion and it is expected that compliance with these new requirements will lead NSF to create new tracking tools to separate out investments related to education and broadening participation. GEO will explore these and other mechanisms for addressing the COV concerns and expects to have a solid response to this issue by the time of the next COV.

FY 2009 Update: There is no update to report at this time.

1.2.2 Engaging Minority Serving Institutions

The COV noted that, while progress had been made in funding projects that directly enhance opportunities for participation of underrepresented groups, the recommendation of the 2003 COV that GEO E&D thoroughly investigate pathway/pipeline issues remained relevant. The COV did not find evidence of significant engagement of tribal universities, community colleges, and other important Minority-Serving Institutions (MSI's) in GEO E&D programs or applying to GEO E&D opportunities, and recommended that GEO collaborate with EHR to explore new opportunities to overcome barriers that prevent participation of MSI's in these activities. (2.2)

GEO Response: GEO agrees with the COV that more progress needs to be made in engaging tribal colleges and universities, community colleges and other MSI's in the GEO E&D programs. The program notes the challenges in doing so because of the lack of geoscience expertise or formal educational programs related to the geosciences at many of these institutions, and therefore feels that one of the more successful strategies would be to find mechanisms for such institutions to partner with each other (e.g., shared resources through a regional collaborative model) or partner with majority institutions that have an existing critical mass of geoscience infrastructure. More outreach to prospective PIs from these institutions is also needed and concrete steps have already been taken to begin this effort. Program staff recently attended the Joint Annual Meeting (JAM) for PIs funded through the Division of Human Resources Development (HRD), which includes those participating in the LSAMP, AGEP, CREST, HBCU-UP, TCUP, RDE, and ADVANCE* programs, and shared information about GEO E&D opportunities in four different panels, including two panels related to Funding Opportunities and break-out sessions for the TCUP and HBCU-UP awardees. The JAM PI meeting is an annual event, and GEO will continue to attend this in the future, as well as seek other venues for increasing outreach to minority institution PIs.

The program also agrees that a more thorough investigation of the pathway/pipeline issues is warranted and has begun to take preliminary steps in defining a framework for this effort. A summer intern working with the Program Officer for Earth Science

* Louis Stokes Alliance for Minority Participation (LSAMP); Alliances for Graduate Education and the Professoriate (AGEP); Centers of Research Excellence in Science and Technology (CREST); Historically Black Colleges and Universities Undergraduate Program (HBCU-UP); Tribal Colleges and Universities Program (TCUP); Research in Disabilities Education (RDE); ADVANCE is not an acronym.

Education began the process of gathering available data related to the geoscience workforce. Within the next year, the program will evaluate appropriate strategies for taking this pilot effort to the next level.

FY 2009 Update: The program has continued its outreach efforts to MSIs by raising awareness of NSF/GEO funding opportunities at the 2009 JAM PI meeting, a Fall 2009 meeting of Presidents and other high level university administrators from MSI's convened by QEM, a special October forum on Tribal Colleges and Universities in Albuquerque, and the 2009 SACNAS conference. The revised OEDG solicitation (NSF 08-605) issued in September 2008 includes a new option for 1-year Planning Grants with the explicit goal of encouraging new partnerships between institutions (and MSI's in particular) that promote engagement of underrepresented minorities in the geosciences. The program supported travel for faculty from 2-year and community colleges to participate in special sessions regarding geosciences programs in these educational settings as part of the 2009 annual GSA meeting; a special focus group discussion by these faculty was convened in conjunction with this session. One of the OEDG Planning Grants awarded from the May 2009 competition will follow-up on this focus group discussion with a larger workshop in summer 2010 regarding support for 2-year and community college faculty and students, many of whom are from underrepresented groups. GEO is also participating in efforts to establish a new Hispanic-Serving Institutions program at NSF.

1.3 DIRECTORATE LEVEL CONCERNS

1.3.1 Program Staffing Needs

The GEO E&D program appears to be attracting a growing number of proposals. The recommendations of this COV encourage program officers to spend considerable time developing and implementing strategies that will enhance the participation of additional Minority Serving Institutions in GEO E&D programs. The additional time and workload generated by the recommended activities, combined with the increasing demands of cross-Directorate and interagency committees and activities, will require additional staff support for GEO E&D to maintain a six month proposal processing time. (4.0)

GEO Response: The Directorate appreciates the COV's concern regarding the level of staff support for the GEO E&D programs. The GEO/OAD programs are currently managed by a Program Director (100% time), 1 Science Assistant (~50% time), and 1 Program Assistant (~50% time); the EAR/EH program has a full time Program Director, with partial staff support from the Division. The GEO/OAD program is also assisted by an Einstein Fellow, who is selected annually from the K-12 teaching community for an 11-month appointment; this person's duties parallel those that might be expected from an Assistant Program Manager, but also includes other activities during the year as part of their Fellowship. With continuity provided by having a permanent program manager, in contrast to staff turnover during the period reviewed by the COV, it is expected that the program will operate more efficiently over time.

Another contributing factor to the substantial workload during the COV review period was the coincidental release of the revised GLOBE solicitation and new GEO-Teach solicitation in late 2005, closely on the heels of the GeoEd proposal deadline. As noted in the COV template, this spike in workload contributed to a longer than desired dwell time of 8.6 months for the GeoEd program. The program believes that the current level of staff support for the collective GEO E&D programs is probably adequate for managing the normal burdens associated with the biannual GeoEd and OEDG programs and occasional (3- to 4-year cycle) GLOBE and GEO-Teach programs, but feels that a re-examination will be warranted once the strategic planning process has been completed. New priorities and strategies for increasing MSI participation in the geosciences that are identified through this process may necessitate increasing program staff, depending on program financial resources.

FY 2009 Update: The past year was uncharacteristically demanding due to the extra funding provided through the American Recovery and Reinvestment Act (ARRA) support, some of which came to the GEO E&D program. In spite of this extra work, the program was able to process all awards by the end of the FY 2009 deadlines. In August 2009, the GEO E&D program chose two Einstein Fellows to serve through Summer 2010. In Spring 2010, it is expected that the Science Assistant associated with the GEO E&D program will increase their effort from half-time to full-time. These additions of more staff support will allow for greater time to be devoted to program management and implementation of strategic planning efforts associated with the GEO E&D programs. However, with the GEO Program Director for Education and Diversity now serving as Co-Chair of the new Climate Change Education Working Group and as Co-Executive Secretary for the NSB Committee on Education and Workforce, and the increasing demands associated with new GEO-EHR collaborations and other cross-NSF education programs, it may be appropriate to re-evaluate at the next COV review whether there is appropriate program support.

2 PROGRAM-SPECIFIC COMMENTS AND RECOMMENDATIONS

2.1 Program Area Gaps and Recommended Improvements

2.1.1 Geoscience Education (GeoEd)

The COV agreed that GeoEd proposals warrant a combined ad-hoc and panel review process but expressed concern that in past years, there was often total overlap between the ad-hoc reviewers and the panel members. (A.1.1)

GEO Response: The program agrees that the GeoEd program is best served by having a combined ad-hoc and panel review of proposals and concurs with the COV that a minimum of four ad-hoc reviews supplied by non-panel members is the desired goal. In the past few years, the pool of reviewers with appropriate expertise has been growing, and the program has continued to add prospective reviewers to the PARS database. The program has pursued every opportunity to identify additional reviewers for this program, including asking for reviewer lists from program officers in the EHR/DUE

program handling geoscience-related projects, and has routinely identified promising candidates encountered at disciplinary meetings. Although the pool of prospective reviewers is growing, the rate of return for ad-hoc reviewers has been low and conflicts of interest are common, which has required the use of panel member reviews. One strategy that will be implemented with the 2007 competition is to contact prospective reviewers in advance of the proposal deadline, to invite their participation in the review process and establish their availability.

FY 2009 Update: As noted above, the program has added a substantial number of new reviewers to the PARS database since the COV, and updates are made to the reviewer pool on a continual basis. Prospective reviewers were contacted in advance of the recent proposal deadlines and polled on their interest and availability in serving as a reviewer. Approximately 50% of those contacted responded, which allowed for a diverse and appropriate set of ad-hoc reviewers and panelists.

The COV expressed concerns that the reasons for funding decisions were not always well communicated to the PIs, noting examples where proposals received all Excellent reviews and a panel "Fund" recommendation, only to be declined by the program. The COV further noted that the rationale behind funding recommendations were often based on factors that were described in the Review Analysis, which is not available to the PI, and not the reviews or Panel Summary. (A.1.5)

GEO Response: GEO agrees that feedback to PIs regarding future resubmission of proposals is important and has instituted routine use of the Program Officer Comment tool, along with direct discussion with the PI, as a mechanism for providing this feedback. See additional comments in Section 1.1.3 above.

FY 2009 Update: The program continues to use the Program Officer Comment tool to provide feedback to all PIs on proposal funding decisions as noted above.

The COV noted that the large number and diversity of the proposals being submitted to the GeoEd program made it challenging to meet the desired six month dwell time for making funding decisions, given current program staff support, and suggested that it may be more realistic to achieve this NSF-wide dwell time goal by adding staff to the management of this program. It was further noted that the long dwell time in 2006 (8.6 months) was due to an anomalous backup of program solicitations and coincidence of three different competitions in a short time span. (A.1.6)

GEO Response: GEO agrees that the GeoEd program has room for improvement in the area of dwell time, but does not feel that additional staff is required to address this specific problem. See additional comments in Section 1.3.1 above.

FY 2009 Update: Due to the extra opportunities and workloads associated with the ARRA funding to NSF, the NSF policy office vacated dwell time expectations for FY 2009.

The COV found that many Form 7s for pre-2006 GeoEd competitions did not explicitly address both merit review criteria very thoroughly and recommended that bold headings be used in the Review Analysis to address each criteria separately and distinctly. (A.2.3)

GEO Response: Since 2006, the GeoEd program has instituted the standard practice of addressing Intellectual Merit and Broader Impacts separately in the Review Analysis for this program. See additional comments in Section 1.1.2 above.

FY 2009 Update: The GeoEd program continues to address Intellectual Merit and Broader Impacts separately in review analyses.

The COV was very complimentary about the quality of the GeoEd projects that were reviewed and felt that, although they could not comment more generally about the entire program, these projects had good potential for having an impact on pedagogical practices in classrooms if they are successful. (A.4.1) The COV noted that the GeoEd solicitation identifies very broad programmatic goals that do not provide adequate guidance to prospective PIs regarding GEO priorities. They recommend that more specific goals which are accompanied by benchmarks or other metrics for program performance would help clarify this issue. (C.2)

GEO Response: The Directorate is pleased that the COV found currently funded GeoEd projects to be of high merit and recognizes the challenge in making a broader assessment of program impact. The potential for impact will be more easily identified once a broader strategic framework for these investments, including goals, expected outcomes, and metrics, has been established (see Section 1.2.1 above). The current GeoEd solicitation (NSF 05-609) will expire after the November 2007 competition, which will allow the solicitation to be revised before being reissued in 2008. The program feels that this more focused solicitation will help ensure that future GeoEd projects are more effective in advancing our knowledge and transforming practice, which should yield results that have much greater impact for the community. The challenge for the program will be to provide sufficient guidance without stifling innovative ideas that may serve the larger program goals.

FY 2009 Update: The program is completing a revision of the GeoEd solicitation, and will be holding another competition in early 2010. The revised solicitation will reflect the GEO E&D Strategic Framework, as well as priorities identified in the GEO Vision document. A smaller number of priority areas are being identified in this solicitation, and clear guidance is being given to prospective PIs regarding other NSF funding opportunities that may address those PI interests that are no longer identified as a priority within the revised GeoEd solicitation.

The COV is concerned that Track 1 GeoEd awards may not have sufficient funding and time to establish metrics that allow the effectiveness of pilot efforts to be demonstrated and thus recommends that the program review the balance between Track 1 and Track

2 funding. Increasing the proportion of Track 1 awards might also enhance the opportunities for innovation. (A.4.2, A.4.3)

GEO Response: GEO shares the concern that the current limits on Track 1 awards are unrealistic, particularly with the recognition that nearly one-third of the project budget supports indirect costs, and agrees that the balance between Track 1 and Track 2 awards and the size and duration of Track 1 awards should be re-examined in light of the new strategic plan. Revision of the GeoEd solicitation for the 2009 competition will allow this adjustment to be made, if warranted.

FY 2009 Update: After consideration of the intent of the Track 1 projects, the program has decided to keep the Track 1 award size and duration the same as in the past. The GeoEd program does not have a large annual allocation and increasing the Track 1 award size would either significantly reduce the number of awards that could be made, or increase the "mortgage" in out-years. Given budget uncertainties beyond FY 2010, this would seem to be a risky strategy at this time.

The COV was unable to evaluate the GeoEd portfolio balance with regard to funding for centers, groups or individuals due to lack of provision of pertinent data. (A.4.5)

GEO Response: GEO will be sure that appropriate information is provided at the next COV so as to allow this assessment and include this as a question to be addressed in future program reviews carried out by the Geoscience Education Working Group.

FY 2009 Update: No update to report at this time.

2.1.2 Opportunities for Enhancing Diversity in the Geosciences (OEDG)

The COV felt that the review process for this program was appropriate for this competition, but was concerned that the low response to review requests indicated that the small geoscience education reviewer community was overburdened. (A.1.1)

GEO Response: GEO has been working to expand the pool of available reviewers both by obtaining lists of reviewers with appropriate expertise used within the EHR Directorate, recruiting new reviewers while attending conferences and national meetings, and better identifying the expertise of existing reviewers who are less well known to the program officer. NSF-wide changes in the functionality of the reviewer and PI database are currently being designed that will allow these systems to be more searchable. These changes will help the program with identifying and using less well known reviewers already in the system, which should help with reducing reviewer fatigue. In addition, GEO is in the process of revamping the GEO Education and Diversity web pages linked from the main GEO home page and the new page will include a link for members of the community to sign up to serve as NSF reviewers, which should help with further expanding the reviewer pool.

FY 2009 Update: To minimize reviewer fatigue, the 2009 OEDG competition used a combined review method, such that the smaller Track 1 proposals were reviewed by a panel only and the larger, more complex Track 2 proposals were reviewed by combined ad-hoc and panel review. This approach seemed to be very successful and led to much more consistent and more easily compared (proposal-to-proposal) evaluations for the Track 1 projects.

The COV is concerned that Track 1 OEDG awards may not have sufficient funding and time to establish metrics that allow the effectiveness of pilot efforts to be demonstrated and thus recommends that the program review the balance between Track 1 and Track 2 funding. Increasing the proportion of Track 1 awards might also enhance the opportunities for innovation, and increase the proportion of new investigators receiving funding. (A.4.2, A.4.3, A.4.6)

GEO Response: GEO shares the concern that the current limits on Track 1 awards may be unrealistic, particularly with the recognition that nearly one-third of the project budget supports indirect costs. GEO also agrees that the balance between the number, size, and duration of Track 1 and Track 2 awards should be re-examined in light of the new GEO E&D strategic plan. While a shift toward more Track 1 support might help with innovation of new strategies related to broadening participation and increase the number of new investigators, it is also true that GEO's investment in many Track 1 projects during the past six years has yielded some promising approaches that deserve scaling up to a Track 2 level for greatest impact. As such, any revisions to the Track 1-Track 2 balance will be made carefully. With the expiration of the current OEDG solicitation (NSF 04-590), the program is in the process of thoroughly reviewing the investments made and outcomes realized from the OEDG investments since 2001. Program evaluation data collected over the years by the American Institutes for Research (AIR) are a valuable resource for this process. GEO plans to release a revised OEDG solicitation in early 2008 that incorporates appropriate changes which reflect both the results of this internal analysis of the OEDG program and input from the broader geoscience community. Revision of the OEDG solicitation for the 2008 competition will allow adjustments in Track 1 and Track 2 allocations to be made, if warranted.

FY 2009 Update: The 2009 OEDG competition was held under new rules that have extended the Track 1 duration to 3 years, and increased the maximum funding amount to $200,000. The addition of $7.0 million in ARRA funding to the OEDG program resources in 2009 enabled the program to support more Track 1 projects, even with this increase in the total budget allowed.

The COV felt that the OEDG portfolio lacked balance in the types of institutions receiving funding and recommended that additional emphasis needed to be given to broadening participation of Minority Serving Institutions (MSIs) and community colleges in the OEDG projects. (A.4.5)

GEO Response: GEO shares the COV's concern that MSIs and community colleges have not been well represented in the projects selected for OEDG funding in the past and is already taking steps to address this issue. The solution to this problem lies both in making MSI and community college investigators more aware of the OEDG program and its opportunities for their institutions, and in helping PIs from such institutions submit more successful proposals to the program. In addition to implementing the outreach activities describe in Section 1.2.2 above, GEO anticipates that revision of the OEDG solicitation for the 2008 competition will lead to inclusion of language that specifically encourages participation of MSIs and community colleges, either through partnerships or as lead institutions.

FY 2009 Update: Of the 90 proposals received for the 2009 OEDG competition, 24 Track 1 and 11 Track 2 awards were made. Of these awards, 9 were made to Minority-Serving Institutions. Among the lead PIs were 7 African-Americans, 2 Hispanic-Americans, and 4 Asians.

2.1.3 Global Learning and Observations to Benefit the Environment (GLOBE)

The COV felt that the review process for this program was appropriate for this competition, but was concerned that the low response to review requests indicated that the small geoscience education reviewer community was overburdened. (A.1.1)

GEO Response: See comments in Section 2.1.2 above regarding increasing the pool of reviewers for the GEO E&D programs.

FY 2009 Update: There is no update to report at this time, as there has been no GLOBE competition since the COV.

The COV felt that the overall quality of the GLOBE program portfolio was appropriate. (A.4.1)

GEO Response: GEO appreciates very much the favorable comments regarding the GLOBE portfolio, particularly as this has been a transition period for the entire GLOBE program and the most recent GLOBE solicitation reflected some significant changes in program expectations and priorities. At the 2007 Annual Meeting of the GLOBE program, held in San Antonio in late July-early August, the new NSF-funded GLOBE projects were a key feature of the agenda. The new projects appear to be well-supported by the world-wide GLOBE community and they have been making excellent progress in their first year of operation in developing high quality materials for teachers and students. The GLOBE Program Office has also done an outstanding job in integrating these projects into their on-going operation and providing them with the support needed.

FY 2009 Update: The Earth System Science Projects (ESSP) continue to make progress on integration of their resources with the broader GLOBE activities. The GLOBE Student Climate Research Campaign has begun pilot efforts, in anticipation of the full 2011-2013 campaign.

2.1.4 Geoscience Teacher Training (GEO-Teach)

The COV recommends a comprehensive review and reconsideration of the goals and implementation of the GEO-Teach program, noting that in its current form, the goal of having a transformative effect on geoscience education is not specific enough with regard to which aspects of geosciences education GEO-Teach wishes to transform (3.6).

GEO Response: GEO agrees that the GEO-Teach solicitation (NSF 06-526) released in late 2005 outlined highly ambitious program goals without providing clear guidance to the community about GEO's priorities for investment. In part, this ambiguity reflected the fact that this was a very new and different program area for GEO, and the program was specifically trying to encourage creative new thinking about how to address this difficult and complex issue of increasing the number of highly qualified geoscience teachers, as required by the No Child Left Behind Act. Although a Letter of Intent (LOI) was required prior to submission of proposals, and the program provided feedback to all PIs submitting LOIs with clarification of program expectations, the program still received a wide variety of proposals in response to the solicitation, reflecting this ambiguity. The two projects selected for funding from the 2006 competition were purposefully funded as three-year projects so that a re-tooled solicitation could be re-issued in the 2009-2010 time frame, factoring in both broader strategic goals for the GEO E&D program and lessons learned from the currently funded GEO-Teach projects.

FY 2009 Update: The program has indicated to the two GEO-Teach projects its willingness to provide small supplemental funding support for related activities of merit, while the program evaluates how to modify the GEO-Teach solicitation in light of the new GEO E&D Strategic Framework and on-going discussions regarding GEO-EHR collaborations. The Earth System Science Education Alliance (ESSEA) Project is currently investigating adaptation of its professional development resources for pre- and in-service teachers for use by high school student audiences as one possible activity that could be implemented through supplemental funding.

The review mechanism for GEO-Teach did include four or more reviewers, but some of the reviews were too brief to provide a useful analysis of the strengths and weaknesses of the proposed project. (A.1.1)

GEO Response: Written reviews for the GEO-Teach proposals were provided by four panel members, who were provided with a review template that prompted them to address both the standard merit review criteria and the additional review criteria identified in the GEO-Teach solicitation. This panel was the third review panel managed by the GEO/OAD within the space of five months and was held close to the time of fiscal year end close-out. As such, program staff was not able to closely monitor the quality of the submitted reviews. When the GEO-Teach competition is held again in the 2009-2010 timeframe, the program will provide much greater guidance to the reviewers and encourage them to elaborate if their reviews are too brief or do not address all of the review criteria. See additional comments in Section 1.1.2 above.

FY 2009 Update: There is no update to report at this time, as there has been no GEO-Teach competition since the COV.

2.1.5 Digital Library for Earth System Education (DLESE)

The COV expressed concerns that there was no clear basis for the projects selected as part of the DLESE portfolio and that the portfolio included projects that were both of high quality and of dubious value. (A.4.1)

GEO Response**:** This issue does not exist any more for DLESE because the digital library is in a transition period moving to a new operating environment. Regardless of the nature of any new initiative, the EAR/EH program will follow best practices in the review process at NSF by including ad-hoc and panel reviews for proposals submitted to the program. In addition, any decision will be clearly explained in the Review Analysis document and communicated to the principal investigator via the Program Officer Comments document.

FY 2009 Update: This program is no longer active, although DLESE continues to operate through the NCAR library and as part of the NSDL.

2.1.6 EAR Education and Human Resources (EAR/EH)

The COV recommended that the EAR/EH programs would benefit from having a broader community of reviewers, particularly ad-hoc reviewers, involved in the review process. (A.1.1)

GEO Response: The program agrees with the COV and plans to follow the same review process that is used in other programs within the Division of Earth Sciences. Each proposal will be sent out for ad-hoc review and then it will be evaluated by a panel. See additional comments in Section 1.1.1 above.

FY 2009 Update: The proposals submitted to the program since the COV (REU site and Postdoctoral Fellowships) have been evaluated by ad-hoc mail reviewers and panels. For each proposal, at least 8 ad-hoc review request letters were sent and at least 3 ad-hoc reviews were submitted for each proposal. The REU site proposals are evaluated by EAR E&HR panel. The postdoctoral fellowship proposals were reviewed by the fall panels of the research programs and the EAR E&HR panel.

2.1.7 REU Sites in EAR

The COV recommended that the REU program would benefit from some degree of standardization in the program evaluation process (3.5).

The COV noted examples in previous reviews of the DLESE and REU programs where a broader community of reviewers would have been preferred. Ad-hoc reviews are especially important to insuring better scientific oversight of the REU projects. (A.1.1)

GEO Response: The program agrees with the COV and plans to follow the same review process that is used in other programs within the Division of Earth Sciences. Each

proposal will be sent out for ad-hoc review and then it will be evaluated by a panel. See additional comments in Section 1.1.1 above.

FY 2009 Update: The REU site proposals submitted to the program since the COV are evaluated by ad-hoc mail reviewers and panels as described above (2.1.6).

The COV noted that the dwell time for REU proposal decisions has been creeping up in recent years, which is of concern because of the importance of recruiting students in a timely manner for summer programs. (A.1.6)

GEO Response: This concern has been addressed by the new solicitation for REU Sites (NSF 07-569) where the deadline for proposals is mid-September in 2007 and mid-August in 2008. The panel for EAR REU Sites will meet in mid-November, with the expectation that PIs will be notified by mid-December of program decisions.

FY 2009 Update: An initial group of PIs was notified in December and early January of their awards allowing time for advertisement and recruitment of participants. Due to the extra funding available through the ARRA, a second group of PIs was notified in February of their awards. These PIs had the option of delaying their REU programs to the summer of 2010, instead of 2009.

The COV felt that the overall quality of the REU program portfolio was appropriate. (A.4.1)

GEO Response: GEO is pleased that the COV felt that the REU program was of high quality and feels that program efforts to further standardize practices in how REU proposals are reviewed and managed will help to further strengthen their quality and impact.

FY 2009 Update: The program continues to pay particular attention to disciplinary, geographic, institutional, and target participant distribution of awards.